CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

Index

ACE inhibitors, 296
activins, 58, 100
adverse events
  bone regeneration and, 92, 93
  cytokines and, 79
  growth factors and, 79
  implant-associated, 293
  micro- and nano-delivery systems, 127
  osteogenic differentiation in cardiac tissue, 39, 44, 46
  transgenic animal tissue and, 227
  tumorigenicity of stem cells, 95, 222, 303, 321
aldehyde dehydrogenase, 279
Alliance for Regenerative Medicine, 3
allogenic cells/tissues, defined, 56
alpha-adrenoreceptor blockers, 18
α_1-adrenoreceptors, 22
alpha-connexin carboxyl-terminal peptide, 299, 303
amphibians, 12, 313, 314, 318, 319
angiogenesis
  bladder regeneration and, 24
  MSC-induced, 37, 38, 39
  tissue engineering biomaterials and, 172, 184
angiotensin receptor blockers, 296
animal models, 219–228
  amphibian, 12, 313, 314, 318, 319
  bladder regeneration, 20, 23, 25–27, 52, 60–62, 63–64
  blood vessels, tissue engineered, 7–10
  challenges of, 220
  classification of, 63
  dogs, 23, 42, 52, 63–64, 224–225
  evolution and species variation, 312–316
  feasibility testing, 219
  foreign body reactions, 295
  future of regeneration, 316–323
  heart valve engineering, 164, 224
  implantation of tissue engineered constructs, 303
  kidney regeneration, 63, 64–66
  muscle regeneration, 7–10, 275
  myocardial regeneration, 36, 38, 42
  porcine, 164, 227
  primates, nonhuman, 225–227
  rabbits, 23, 223
  renal disease, 65
  rodents, 65, 220–223, 299, 319
  scar formation and, 298
  selection of, 11
  sheep, 224
  transgenic tissue transplantation, 227
  wound healing, 299, 303
antimuscarinic drugs, 18
α_1-adrenoreceptor blockade, 22
Arg-Gly-Asp, 174, 176, 180, 181
Armed Forces Institute of Regenerative Medicine (AFIRM), 3
atrioventricular valves, 157, 159, 162
autologous cells. *See* patient-specific cells
avidity, 138
axolotl regenerative abilities, 318

basic fibroblast growth factor (bFGF), 24
β-galactosidase, 210
biliary tree stem cells, 88, 90
biodegradable materials. *See* under tissue engineering biomaterials
bioelectrical signals, 313
bioengineered tissue. *See* tissue engineering
bioinformatics, 211
biointegration, 168
biological responses, measurement of
  enzyme reporters, 203–204
  fluorescent proteins, 204–207
  luciferase system, 202–203
  second messengers, 207–211
biomaterials. *See* tissue engineering biomaterials
biomatrices, defined, 87
bioreactor technologies
  categories of, 159
  complex bioreactors, 163–165
  defined, 11
  flexure duplicator reactors, 161
  flow duplicator reactors, 161–163
  fluorescent protein technology, 204–207
  preconditioning, 7
  pressure duplicator reactors, 160
  second messenger measurement, 207–211

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

bioreactor technologies (*cont.*)
tissue engineered blood vessels, 7–10
bladder
capacity of, 19, 23, 24
neural control of function, 63
as regenerative pharmacology model, 20
restoration of function, 64
bladder acellular matrix, 24, 25, 27–28
bladder augmentation
animal models, 23
as gold standard, 18
growth factors and, 24
intestinal mucosa for, 19, 27, 52
tissue engineering approaches to, 19
bladder regeneration, 52–67
active, pharmacology of, 24–27
animal models, 20, 23, 25–27, 52, 60–62, 63–64
approaches to, 18–20, 52, 54–56, 59
biomaterials used, 57–58
capacity restoration, 23, 24
cellular components and, 27, 56
clinical experiences, 19–20
contractility and, 22, 23, 24
de novo, 19–20
evaluation of extent of, 60–62
functional, 20, 22, 64
goals of therapy, 59
growth factors, 24–25, 27–28
histological evaluation, 61
innervation and, 22
multidisciplinary approach, 20
neo-organ constructs, 19, 52, 57
outcomes evaluation, 53
passive, pharmacology of, 20
scaffolds, 23–24, 57, 64
species variations in capacity, 23
stem/progenitor cells and, 25
blastema formation, 314, 315
blood-brain barrier, 137
bone fractures, 91
bone marrow transplantation, 77, 78, 80
bone morphogenetic proteins, 91–92, 93, 185, 316, 318, 319
bone regeneration
animal models and, 224
approaches to, 92
cytokines, 91
growth factors and, 185
Hedgehog pathway, 93
MSCs and, 90–94
osteogenesis, activation of, 181
osteogenic differentiation, 93, 94
safety and efficacy, 92, 93

CADUCEUS study, 259, 262
cadherin expression, 242
calcium dysregulation, 280
calcium ion mobilization, 210
cancer
c-Myc oncogene, 222
drugs interacting with tyrosine kinases, 194
erythropoietin and, 79
tumorigenicity of stem cells, 95, 222, 303, 321
tumors, nanocarrier delivery to, 136
cardiac arrhythmias, 237–247
action potential propagation, 240, 245
gap junction blockers and, 241
gap junctions and, 237, 240–246
ischemia and, 241
reentrant pathway, 241
therapies for, 242–246
cardiac embryonic development, 158–159, 162
cardiac mechanics
components of, 40–45
heart valve engineering and, 161
MSC implantation and, 36, 43–45
tensegrity model, 161
valve development and, 159
cardiac muscle. *See* myocardium
cardiac pacemaker current, 244–246
cardiac patches with MSCs, 38
cardiac pharmacology, regenerative, 34–46, 252–263
animal models for, 36, 38, 224
cardiac stem cells, 257–259, 262
differentiation, osteogenic, 39, 44, 46
differentiation of stem cells, 35, 36, 38, 43–45, 253
ischemic heart failure, 39, 252
MSC delivery, 36–40, 43–45, 257
next generation of therapy, 262
quality control, 256
repair mechanisms, 34, 35, 38, 253
safety and efficacy, 39, 46, 253, 261
cardiac stem cells, 39, 257–259, 262
cardiopoietic guidance, 260
cardiovascular valve replacement, 157–163
animal models for, 164, 224
autologous constructs, 157, 159
complex bioreactors, 163–165
flexure duplicator reactors, 161
flow duplicator reactors, 161–163
mechanical vs. biological valves, 157
pressure duplicator reactors, 160
stem cell seeded scaffolds, 44
treatment options, 157
valve anatomy and, 159
carotid artery grafts, 7
cartilage, articular, tissue engineering, 183
catenin expression, 242
C-CURE clinical trial, 261, 262
cell signaling, 212–213
cell-level delivery, 138–141
chemical biology, 193–195
chemilumnescent reporter system, 202–203
cheminformatics, 211–212
chemisorption, 176
chemoattraction, 173
cholangiocytes
biliary tree stem cells and, 88
hepatic stem cells and, 85
precursors, 85, 87
cholesterol metabolism, 102
chronopharmacology, 56, 60
circulation time
local delivery systems, 142
nanocarrier targeting and, 137

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

polymer-based delivery systems, 129, 138
systemic delivery systems, 128
C-kit, 258, 262
clinical trials and applications
bladder regeneration, *de novo*, 19–20
cardiac regeneration, 253, 259, 261
hepatic stem cell therapies, 86
multidisciplinary approach and, 322
myogenic cell transplantation, 274
neo-tissues and neo-organs, 52
spinal cord injuries, 101
stem cell-derived products, 101
c-Myc oncogene, 222
coelentrazine, 203
collagen, 177
collagen patches with MSC, 38
collagen synthesis inhibitors, 295
collagen tubes, 162, 301
colony-stimulating factors, 78
combinatorial chemistry, 195–198
complement activation, 276
connexins
biophysical properties, 239
cardiac arrhythmias and, 241
expression and MSCs, 243–246
ischemia and, 241
over-expression of, 242–246
permeability, 238–239
pharmacological stimulation, 242
structure of gap junctions channels, 237–238
tissue repair and, 298, 299
viral delivery of, 242
constructs. *See also* scaffolds; tissue engineered construct implantation; *specific tissue types*
bladder, neo-organ, 19, 52, 57
cell numbers, 61
colonization mechanisms, 173
defined, 52
future of, 322
modified PEG and, 174, 176
skeletal muscle repair, 7–10
controlled release systems. *See also* micro- and nano-delivery systems
challenges, 128
safety and efficacy, 127
scaffolds and, 143
stimulus-responsive systems, 149
COX-2 inhibitors, 295
curative vs. palliative therapies, 4, 13
cyclic AMP (cAMP) measurement, 210
cyclooxygenase-2 (COX-2) inhibitors, 295
cystectomies, 19, 20, 64
cystoplasty, 52
cytokines. *See* under *specific cytokines*
bone morphogenetic proteins, 91
cell homing to myocardium, 39
functions of, 77
hematopoietic, 78–79
neural cell precursors and, 79
off-target effects, 79
wound healing and, 291

Dacron grafts, 167, 169
delivery systems. *See also* lipid-based delivery systems; micro- and nano-delivery systems; polymer-based delivery systems; systemic delivery systems
cell-level, 138–141
controlled release, 127, 128, 143, 149
DNA and, 128, 140, 147, 148, 149
layer-by-layer release, 147–148
local, 141–144, 146–147
pumps, implantable, 294
vascular-level, 134, 257, 278
diabetes, 294, 303
diastolic phase duplicators, 164
digit tip regeneration, 319
"disease in a dish" strategies, 101–104
DNA
delivery challenges, 128
informatics and, 212
layer-by-layer delivery, 147, 148
sub-cellular delivery of, 140
surface-mediated delivery, 149
dogs as animal models, 23, 42, 52, 63–64, 224–225
dose-response relationships, 55
drug delivery. *See* delivery systems
drug discovery technologies, 190–215. *See also* high throughput screening,
biological responses, measurement of, 198–211
challenges of, 213–215
chemical biology and, 193–195
combinatorial chemistry and, 195–198
fluorescent protein technology, 204–207
history of discoveries, 190–192
informatics, 211–212
luciferase system, 202–203
modulators of proliferation and differentiation, 212–213
second messenger measurement, 207–211
stem cells and, 215
Duchenne muscular dystrophy, 103–104, 270, 271, 280
dystrophin, 270, 271

ECM. *See* extracellular matrix (ECM)
Ehrlich, Paul, 190
electrospun fibers
bioactivity, 147
drawbacks, 147
formation methods, 146–147
tissue engineering biomaterials, 174, 181, 184
emulsification, 145
end organ disease and failure, 5–7
end stage renal disease, 18
endocytosis, mechanisms of, 139
endodermal transcription factors, 100
enzyme reporter systems, 202
epidermal growth factor (EGF), 58, 184
epimorphosis, 313, 314
epithelial to mesenchymal transformation, 158–159
erythropoietin (EPO), 77, 79
evolution of regenerative capacity, 311, 312–316
extracellular matrix (ECM)
biomaterials as surrogate for, 167
bladder regeneration and, 27–28
components of, and maintenance of differentiation, 87

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

extracellular matrix (ECM) (*cont.*)
  derivatives in tissue engineering, 181
  growth factors and, 27–28, 182–185
  tissue engineered heart valves and, 160
  tissue engineering biomaterials and, 168, 177–185
extravasation, 134, 136, 137
eye regeneration, 315, 318. *See also* retina regeneration

fibroblast growth factor, 176
fibroblasts, cardiac, 43
fibronectin, 177, 182
fibrosis. *See also* scar formation
  cardiac remodeling, 296
  encapsulation of implants, 292, 293, 294, 295, 297, 299–300
  myocardial, 36, 42
  osteopontin and, 297
  regeneration vs. repair and, 53, 292–293, 294
finite element model, 43
flexure duplicator reactors, simple, 161
flt-3 ligand, 80
fluid balance and cardiac tissue, 42
fluid dynamics, computational, 162
fluid flow duplicator reactors, simple, 161–163
fluid shear stress and myocardium, 44
fluorescent imaging plate reader (FLIPR) technology, 210
fluorescent protein technology, 204–207
follistatin, 58
foreign body reaction
  animal models, 303
  implantation of tissue engineered constructs, 291, 293, 294
  pharmacological modulation of, 294
  physiological responses to implants, 291

gap junctional blockers, 241
gap junctions. *See also* connexins
  structure of channels, 237–238, 298
  tissue repair and, 298
gap junctions, cardiac
  action potential propagation, 240
  cardiac arrhythmias and, 237, 240–246
  MSCs and, 243–246
  pacemaker current and, 244–246
  permeability, 238–239
  role of, 237, 238, 239
gelatin, 176
gene expression
  cardiac pacemaker current, 244
  epigenetic memory of stem cells, 95
  epigenetic silencing of, 81
  fluorescent protein technology, 204
  reporter enzymes, 202
  stem cells as delivery vehicles, 243
genetic disorders. *See also* Duchenne muscular dystrophy
  animal models for, 224
  patient-specific stem cells for modeling, 101–104
  rationale for regenerative pharmacology, 12
genetic model of glomerulonephritis, 65
genetic modification of stem cells, 221
glomerulonephritis, 64
glucocorticoids, 296
granulocyte colony-stimulating factor (G-CSF), 77
granulocyte-macrophage colony-stimulating factor (GM-CSF), 78
green fluorescent protein, 204, 207
growth factors. *See also specific factors*
  bladder regeneration, 24–25
  bone regeneration, 93, 185
  degradation of, 182
  hepatocyte, 58, 176, 184
  implantation of tissue engineered constructs, 297
  kidney regeneration, 58–59
  layer-by-layer delivery, 147
  local delivery systems for, 143
  macrophage differentiation, 184
  muscle repair and, 273
  off-target effects, 79
  release mechanism, 183
  roles in regenerative process, 58–59
  stem cell migration and, 182
  tissue engineering biomaterials and, 176, 182–185
  wound healing and, 183, 291, 297

HCN2 pacing gene, 243, 244–246
heart, structure of, 40, 158
heart disease statistics, 252
heart failure, 39, 252
heart valves. *See* cardiovascular valve replacement
Hedgehog pathway, 93, 316
hematopoiesis as model for regenerative pharmacology, 77–83
hematopoietic stem cells
  animal models and, 226
  characteristics of, 77
  cytokines and, 78–79
  expansion, 79–81, 82
  MSCs and, 221
  self-renewal, 80, 82
  small molecules and, 81–83
hepatic stem cells
  clinical therapies, 86
  differentiation, 85, 87–88
  dissociation and cryopreservation, 86
  isolation and expansion, 83–90
  liver regeneration and, 83
  multipotent endodermal, 88–90
  progenitors vs. differentiated stem cells, 97
hepatoblasts, 84
hepatocyte growth factor, 58, 176, 184
hernia repair, 301
heterologous cells/tissues, defined, 57
high content screening microscopes, 198, 207
high-throughput screening
  assay platforms, compatible, 198
  automated cell culture systems and, 198
  biological responses, measurement of, 198–211
  cardiomyocyte phenotype, 105
  combinatorial chemistry and, 195–198
  fluorescent protein technology, 204–207
  history of drug discovery and, 191, 192
  informatics and, 211–212
  luciferase system, 202–203
  prediction of drug activities, 194

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

second messenger measurement, 207–211
small molecules and, 213
homologous cells/tissues, defined, 57
Hox genes, 315
hyaluronic acid and hyaluronans
augmentation cystoplasty and, 25
hepatic stem cell expansion and, 85, 86
implanted devices and, 297
hydra regeneration, 314
hydrogels
hepatic stem cell differentiation and, 85, 87
stabilization of, 174
tissue engineering biomaterials and, 174, 176, 181, 183
hyperthermia, 138
hypoxia. *See* oxidative stress

immune response. *See also* inflammation
approaches to reduction of, 290
autologous approaches and, 57
bladder augmentation and, 27
cardiac stem cell transplantation, 255
implantation of tissue engineered constructs, 290, 293–294
muscle regeneration and, 272
myogenic cell transplantation and, 272, 275–277
patient-specific stem cells, 95
implantation of tissue engineered constructs. *See* tissue engineered construct implantation
(–)-indolactam V, 100
inducers of definitive endoderm, 100
inflammation
angiotensin receptor blockers, 296
connexins and, 298
implantation of tissue engineered constructs, 293–294, 296, 297
mediators of, 295
myogenic cell transplantation and, 275, 276, 279
steroidal anti-inflammatory drugs, 296
wound healing and, 291
informatics, 211–212
infrared fluorescent proteins, 207
INFUSE bone graft, 91
injury. *See* wound healing
insulin-producing cells, 97
integrins, 181
intercellular adhesion molecule 1 (ICAM-1), 134
intravenous delivery. *See* systemic delivery systems
ischemia
cardiac arrhythmias and, 241
myocardial, 34, 36, 39, 261
Islet-1, 258

kidney regeneration, 52–67
acute renal failure and, 59, 62
animal models, 63, 64–66
basic tools and approaches, 54–56, 59
cell/tissue based therapies, 56
growth factors, 58–59
outcomes evaluation, 53
pharmacological evaluation of, 63, 64, 65
routes of, 62–63
stem cells and, 62

laminin, 174, 177, 181
layer-by-layer release, 147–148
lens regeneration, 318
ligands
coupling to PEG, 138
multiple, on nanocarriers, 138
promoting sub-cellular uptake, 141
limb regeneration, 313, 314
lipid-based delivery systems
advantages of, 128
local delivery and, 143
microbubbles, 134
"smart" agents, 140
liver disease, end-stage, 86
liver regeneration. *See* hepatic stem cells
local delivery systems
electrospun fibers, 146–147
micro- and nano-delivery systems, 141–144
spatio-temporal control, 141, 143
luciferase system, 202–203

macrophage differentiation, 184
macrophage infiltration, 275, 276, 277, 279
mesenchymal stem cells (MSC)
animal models and, 220
bone marrow-derived, 39
bone tissue engineering, 90–94
2D culture and cyclic tension, 43
defined, 90
differentiation, 221
genetically modified, 221
mechanical properties of, 45
rodent animal models and, 220
tissue engineering and, 221
vs. acellular therapies, 39
mesenchymal stem cells (MSC), cardiac applications of, 34–46
animal models for, 36, 38
approaches to cell delivery, 36–40, 257
arrhythmia therapies, 242, 243–246
differentiation, osteogenic, 39, 44, 46
differentiation/phenotypes, 35, 36, 38, 43–45
gap junction formation and, 243–246
heart valves, 44
ischemia and, 34, 36, 39
paracrine action and, 35, 38, 253
repair mechanisms, 34, 35, 38, 253
safety and efficacy, 39, 253, 261
stem cell lineage specification, 259–261
ventricular myocytes coupled to, 244–246
mesenchymal stromal cells, 90
Michael-type reaction, 174
micro- and nano-delivery systems, 127–149
advantages compared, 143
cell-level and sub-cellular, 138–141
challenges of, 128, 129, 138, 145
clearance rates, 128, 137, 142
controlled release, 127, 143
defined, 127
degradation rates, 128, 139
efficacy of, 127
electrospun fibers, 146–147
local, 141–144, 146–147

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

micro- and nano-delivery systems (*cont.*)
  modulation of carrier properties, 139
  multiple agent, 143
  polymer- or lipid-based, 128, 144–146
  stimulus-responsive, 149
  surface-mediated, 148
  systemic, 129–133
  tissue-level, 136–138
  types of systems, 129–133
  ultrasound and, 134
  vascular-level, 134
microbubbles, lipid
  imaging modalities and, 134
microcarriers. *See also* micro- and nano-delivery systems
  adhesion behavior of, 134
  advantages of, 143, 148
  defined, 127
  protein bioactivity, 145, 148
microtiter plates, 197–198, 210
mitochondria, 280
mitogen activated protein kinase (MARK) pathway, 317
mix-and-split technique, 195
molecular biology, 192
morphallaxis, 313, 314
morphological restoration, 315
MSC. *See* mesenchymal stem cells (MSC)
muscle repair, 270–281. *See also* cardiac pharmacology, regenerative; myocardium
  animal models, 7–10, 275
  challenges/limitations of, 271, 272, 274, 276, 300–303
  contractility, 10, 22, 23, 24, 41
  muscle-derived stem cells and, 270, 274, 278–280
  physiological response to injury, 271, 272–273, 276
  satellite cells, 271, 272–273, 274, 276, 300
  skeletal, 7–10, 271, 299–303
  smooth muscle cells, 22, 23, 25, 43, 44, 45
  transplantation of myogenic cells, 271, 272–278
muscular dystrophies, 103–104, 270, 271, 280
myoblast transfer therapy, 270
myocardial infarction
  animal models for, 38, 42
  cardiac mechanical properties and, 42
  therapeutic options, 252
myocardium. *See also* cardiac pharmacology, regenerative
  biochemical environment of, 34
  cardiac stem cells, 39, 257–259, 262
  cardiomyocyte contractility, 41
  cardiomyocyte maturation, 181
  differentiation, 105
  extracellular matrix derivatives and, 181
  extracellular matrix structure, 35, 45
  fluid shear stress and, 44
  heart structure, 40
  interstitial fluid and perfusion, 42
  ischemic and fibrotic, 37
  mechanical environment of, 36, 40–45
  muscular dystrophy and, 103–104
myogenesis, MSC-induced, 37
myogenic cell transplantation, 270–281
  antioxidant capacity of cells, 278–280
  calcium dysregulation and, 280
  candidate progenitors, 273
  challenges of, 271, 272, 274, 276
  death of transplanted cells, 272, 276
  delivery of cells, 278
  differentiation, 273, 274
  immune response and, 272, 275–277, 278
  migration, 277
  mitochondria and, 280
  reactive oxygen species, 272, 275, 278–280
  satellite cells and progenitors, 271, 272–273
myotubes, 319

nanocarriers. *See* micro- and nano-delivery systems
  advantages of, 143, 148
  cellular uptake, 139
  components of, 149
  defined, 127
  extravasation, 136
  modifications, 133
  scaffolds and, 148
  surface charge modification, 137
natural killer cells, 277
neo-organs
  bladders, 19, 52, 57
  defined, 52
neo-tissues, defined, 52
nephrectomy models, 64
nerve growth factor, 24, 185
nerve regeneration and neurogenesis
  CNS disorders, 12
  growth factors and, 185
  peripheral nerves, 182
  polymers with laminin, 181
  promotion of, 99
neural cells, differentiation, 99, 102
neural stem cells, 99, 223
neurogenic bladder overactivity, 18, 19
neurotrophic factors, 182, 185
neutrophil migration, 184, 275, 276, 279
newt regenerative abilities, 313, 314, 318, 319
NFκB nuclear translocation, 276
nitroreductase, 203–204
Notch signaling, 99, 319
nuclear localization sequences, 140
nucleic acids, 128. *See also* DNA

osteogenesis, activation of, 181
osteogenic differentiation
  bone regeneration, 94
  of cardiac-implanted MSCs, 39, 44, 46
  Wnt signaling, 93
osteoinductive substances, 93
osteopontin, 297
oxidative stress. *See also* reactive oxygen species
  hematopoietic stem cell expansion and, 82
  MSCs and, 45
  muscle regeneration and, 272, 275
  normal defenses, 280

pancreas, stem cells and, 88, 90, 100. *See also* insulin-producing cells
parthenogenesis, 223

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

patient comorbidities and wound healing, 293, 303
patient-specific cells
  autologous cells, defined, 56
  bioreactor technologies, 11, 159
  cardiac regeneration and, 261
  challenges of, 303
  development of stem cell lines, 103
  differentiated, production of, 96, 102
  disease models and, 101–104
  heart valves, 157
  induced pluripotent stem cells, 94
  neo-tissues and neo-organs, 52
Pax-6 gene, 315
PEG. *See* poly(ethylene glycol) (PEG)
pharmacogenomics, 194
photoactivatable fluorescent proteins, 207
physisorption, 176
piezoelectric wafer active sensors, 295
planarian regeneration, 313, 314, 315, 317
platelet-derived growth factor (PDGF), 144, 182
pleiotrophin, 81
plerixafor, 79
poly(caprolactone) (PCL), 177
poly(ethylene glycol) (PEG)
  biodegradability, 174
  circulation time and, 129, 137, 138
  ligand interaction and, 138
  modified, 174, 180
  tissue engineering biomaterials, 174, 180, 182
polyethylene glycol-modified fibrin, 38
poly(ethylene terephthalate) (PET), 167
polyethylenimine (PEI), 140
poly(lactide-co-glycolide) (PLGA), 144
poly(L-lactic acid) (PLLA), 174, 181
polymer-based delivery systems
  active factor incorporation, 177–182
  advantages of, 128, 129
  degradable, 160, 173
  degradation products, 146
  efficacy of, 129
  electrospun fibers, 146–147
  layer-by-layer release, 147–148
  microparticle materials used in, 134, 144–146
  “smart” agents, 140
  stability of microcarriers, 146
  tissue engineering biomaterials, 177–182
  water-in-oil emulsions, 145
porcine models, 227
pressure duplicator reactors, simple, 160
preventive effects vs. treatment effects, 54
primates, nonhuman, 225–227
progenitor cells. *See also* stem and progenitor cells
  cardiac stem cells, 257, 260
  characteristics of, 75
  myocardial, recruitment, 254, 257–259
  myogenic, 270, 271, 272–278, 300
  preservation of phenotype, 279
proliferating cell nuclear antigen, 20
prostaglandins, 295
proteins
  activity of, in microcarriers, 145, 148
  extracellular matrix, biomaterials with, 177–182
  layer-by-layer delivery, 147
  sub-cellular delivery of, 140
proton sponge hypothesis, 140
purmorphamine, 93

quantum dots, 246

rabbits as animal models, 223
reactive oxygen species, 272, 275, 278–280. *See also* oxidative stress
regeneration, 311–323
  advances in scaffolds/constructs, 322
  animal models, 312–316
  comparative analysis across species, 316–323
  defined, 312
  endogenous, induction of, 323
  evolutionary theory and, 311, 312–316
  mechanisms of, 312
  morphogenesis, 315
  multidisciplinary approach, 322
  precursor regeneration, 313
  present and future of, 316–323
  response to injury, 312, 313
  species variation in, 312–323
  vs. repair, 53, 292–293, 294
regenerative medicine
  aims of, 53
  approaches/tools/strategies, 56–59, 320–323
  cell/tissue-based therapies, 56
  chemical biology and, 195
  defined/characterized, 3, 312
  growth factors and, 58–59
  history of, 4, 311
  national strategy for, 3
  scaffold types and characteristics, 57–58
regenerative pharmacology
  aim of, 4, 18
  applications of, 10
  approaches and tools, 54–56
  bladder as model for, 20
  chronopharmacology, 56
  curative therapies and, 4, 13
  defined, 3, 15, 54
  directing vs. dissecting approaches, 7, 10, 15
  dose-response relationships, 55
  Duchenne muscular dystrophy as model for, 103–104
  hematopoiesis as model for, 77–83
  iterative process, 6–7
  organ disease and failure, 5–7
  scope/applications/contributions of, 5–7
  structure-activity relationships, 55
  treatment approaches, 11
renal disease models, 59, 65
renal failure, acute, 59, 62, 65
renotropic system, 62
reporter systems, 202
reprogramming
  epimorphic regeneration and, 314
  fibroblasts, 102, 103, 321
  mature somatic cells, 76, 94, 262
  pharmacology of, 95–96
retina regeneration, 317
retinal pigment epithelium, 101, 317
robotics. *See* high-throughput screening

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

rodents as animal models, 65, 220–223, 299, 319

salamander regenerative abilities, 318
satellite cells, 271, 272–273, 274, 276, 300
scaffolds. *See also* constructs; tissue engineered construct implantation; tissue engineering biomaterials
  animal models and, 224
  biointegration, 168
  biomatrices for hepatocytes, 87
  bladder regeneration, 23–27
  bone regeneration, 92
  coaxial approach, 147
  collagen tubes, 162, 301
  controlled release systems, 143, 144
  cyclic flexure to stiffen, 161
  degradation rates, 160, 183
  electrospun, 146–147, 174, 176, 181
  heart valve engineering, 161, 162, 164
  nanocarriers and, 148
  polymers for, 146
  types and characteristics of, 57–58
  vasculature and, 172
scaffolds, seeded
  bladder regeneration, 19, 23, 26, 57, 61, 64
  bone marrow mononuclear cells, 38
  cell adhesion and, 177
  cell numbers, 61
  future of, 322
  heart valve engineering, 161
scar formation, 291, 292, 294, 298, 299, 302. *See also* wound healing
SCIPIO trial, 259, 262
second messenger measurement, 207–211
semilunar valves, 157, 159, 162
shear strain, 43, 162
sheep as animal models, 224
sialyl Lewis, 134
silicone disk contraction capsules, 299–300
single dose effect studies, 54
six3 transcription factor, 318
skin tissue engineering, 177, 182, 184
skin wound healing, 292, 296, 299–303
small molecules
  biomaterials with extracellular matrix proteins, 177–182
  cell signaling and function, 212–213
  as mechanistic probes and tools, 98–101
  osteogenesis and, 94
  second messenger measurement, 207–211
  stem cell modulators, 81–83, 98–101, 213
"smart" agents, 140
smooth muscle cells
  bladder regeneration and, 22, 23, 25
  cardiac stem cells, differentiation into, 43, 44, 45
smoothened activation, 94
spatio-temporal control, 143
spinal cord injuries, 25, 101, 185
spinal fusions, 91, 92
spinal muscular dystrophy, 102
"stealth technology," 137
stem and progenitor cells, 75–104. *See also* progenitor cells
  biliary tree and, 88
  bladder regeneration and, 25
  defined, 75
  differentiation, 75–104
  epimorphic regeneration and, 314
  Hedgehog pathway, 93, 316
  proliferation/expansion, 79–81, 83
  small molecules and, 213
stem cell factor, 80
stem cells, 75–104. *See also* hematopoietic stem cells; hepatic stem cells; mesenchymal stem cells (MSC)
  amnion-derived, 226
  animal models and, 225–227
  biliary tree and, 88
  biology and pharmacology of, 75
  cardiac, 39, 257–259, 262
  challenges and advances, 215, 320
  characteristics of, 75
  clinical trials and applications, 86, 101, 253, 259, 261
  de-differentiation, 215, 314, 319, 321
  expansion assays, 82
  genetically modified, 221
  hepatic therapies, 86
  kidney regeneration, 62
  mechanical forces, response to, 40–45, 85
  migration, 182
  multipotent, 88–90
  muscle-derived, 270, 274, 278–280
  neural differentiation of, 99
  from peripheral blood, 226
  phenotypic screens, 98, 105
  porcine, 228
  proliferation/expansion factors, 79–81, 212–213
  regulation of, 76
  reprogramming, 76, 94, 95–96
  retinal pigment epithelium and, 101
  self renewal, 76
  signaling mechanisms, 93
  spermatogonial, 226
  spinal cord injuries and, 101
  stress tolerance, 279
  "transdifferentiation", 96
  tumorigenicity, 222, 303, 321
stem cells, adult
  challenges of, 320
  characteristics of, 76, 97, 242
  engineering lineage specification, 254, 259–261
  guided cardiopoiesis, 260
  propagation, 77
  self-renewal, 76
  sources of, 260, 320
stem cells, cardiac regeneration, 252–263
  challenges of, 261, 262
  clinical experience, 253, 259, 261
  current state of, 261
  delivery systems, 257
  differentiation, 35, 36, 38, 43–45, 253
  differentiation, osteogenic, 39
  engineering lineage specification, 254, 259–261
  homing capacity, 39, 252, 257
  mechanism of/paradigm of, 252
  next generation of therapy, 262
  progenitor cell recruitment, 254, 257–259

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

quality control, 256
scale-up production, 255
stem cells, differentiation
aldehyde dehydrogenase and, 279
challenges of, 97
directed, 87, 94, 96–98
in heart, 35, 36, 38, 39, 43–45, 253
maintenance of, 225
molecular modulators of, 212–213
osteogenic, 39
pharmacology of, 87, 98–101
tissue engineering biomaterials and, 172–177
stem cells, embryonic
animal models and, 222, 225
challenges of, 320
clinical trials of products derived from, 101
differentiation, 97, 225
fluid shear stress and, 44
lineage commitment, 260
monkey, 226
parthenogenesis, 223
porcine, 228
self-renewal, 76
teratoma formation, 303
stem cells, induced pluripotent
adverse events and, 222, 321
challenges of, 95, 321
defined, 76
differentiation, 97, 98–101
epigenetic memory, 95
generation methods, 94, 96
history of, 321
neural differentiation of, 99
patient-specific therapies, 94
stem cells, pluripotent
defined, 76
differentiation, directed, 94, 96–98
disease models from patient-specific cells, 101–104
drug development technologies and, 215
generation of, 76
monkey, 226
potential and challenges of, 94–95
StemRegenin 1, 82
steroidal anti-inflammatory drugs, 296
stimulus-responsive systems, 149
structure-activity relationships, 55
sub-cellular delivery, 138–141
surface-mediated delivery, 148
sustained release. *See* controlled release systems
systemic delivery systems
advantages of, 128
challenges of, 128, 129–133
circulation time, 142
myogenic cell transplantation, 278
vascular-level delivery, 134, 257

tacrolimus, 277, 278
tail regeneration, 313, 318
temporal relationships. *See* chronopharmacology; spatio-temporal control
tensegrity model, 161
"theragnostics", 134
Thiazovivin, 86
thrombin, 319
thrombopoietin, 80
time-dependent cell response profiling, 105
tissue engineered construct implantation, 290–304. *See also* constructs; scaffolds
animal and cell models, 303
challenges of, 294, 304
complications/adverse events, 293, 294, 299–300
foreign body reaction, 291, 293, 294
pharmacological modulation of wound healing, 294
physiological responses to, 290, 291
regeneration vs. repair and, 292–293, 294
skeletal muscle, 300–303
stem cells types for, 303
wound healing, 291
tissue engineering. *See also* bioreactor technologies; tissue engineered construct implantation; *specific tissues*
animal models and, 221, 227
bladder augmentation, 19
characterization after implantation, 10
complex bioreactors, 163–165
covalent bonding, 176
flexure duplicator reactors, 161
flow duplicator reactors, 161–163
pressure duplicator reactors, 160
skeletal muscle repair, 7–10, 299–303
tissue engineering biomaterials, 167–186
active factor incorporation, 167–168, 172–182
bladder regeneration, 23–24, 25–27, 57–58
colonization mechanisms, 173
degradable polymeric options, 169, 174
degradation product characteristics, 172
degradation rates, 160, 169
delivery systems, 173
extracellular matrix proteins and, 177–182
growth factors and, 176, 182–185
limitations of, 167
methods for functionalization, 167, 172–177
physiological properties, 167
properties of ideal constructs, 168–172
small molecules, 177–182
stem cell lineage specification, 259–261
vasculature and, 172
tissue-level delivery, 136–138
transcription factors, 96, 215, 315, 318
transcytosis, 137
transdifferentiation, 96, 314, 317, 318, 321
transforming growth factor-alpha (TGF-alpha), 59
transforming growth factor-beta (TGF-beta), 58, 59, 176, 177, 183, 297
translational research, 4
transplantation. *See* myogenic cell transplantation; stem cells
bladder neo-organs, 19, 52, 57
bone marrow, 77, 78, 80
cell sources for, 320–322
myoblasts, 270, 271
transgenic tissue, 227
xenotransplantation, 227
tubulointerstitial fibrosis, 64
tumorigenicity of stem cells, 95, 222, 303, 321
tumors, nanocarrier delivery to, 136

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-89949-9 - Regenerative Pharmacology
Edited by George J. Christ and Karl-Erik Andersson
Index
More information

TWS119, 99
Tyrintegin, 86
tyrosine kinases, 194

ultrasound, 134, 149

vascular endothelial growth factor (VEGF)
  bladder regeneration, 24
  in cardiac MSC implantation, 35, 38
  delivery system effects, 143
  local delivery systems, 144
  tissue engineering biomaterials and, 184
vascular grafts
  Dacron, 167, 169
  ideal properties of, 168
  tissue engineered blood vessels, 7–10
vascular-level delivery. *See also* extravasation
vascular-level delivery, 134, 257, 278
VEGF. *See* vascular endothelial growth factor (VEGF)
viral integrations, 222, 242
vocal cord regeneration, 184

water-in-oil emulsions, 145
water-in-oil-in-water emulsions, 145
Wnt signaling
  bone regeneration, 93
  neurogenesis, 99
  off-target effects, 80
wound healing. *See also* muscle repair
  alpha-connexin carboxyl-terminal peptide, 299
  animal models, 299, 303
  growth factors and, 183, 184, 297
  immune response and, 293–294
  implantation of tissue engineered constructs, 291
  patient co-morbidities, 293, 303
  pharmacological modulation of, 294
  regeneration vs. repair and, 292–293, 294
  skin, 292, 296, 299–303
  stages/mechanisms of, 291, 312, 313

xenogenic cells/tissues, defined, 57
Xenopus, 313, 317, 318
xenotransplantation, 227
xenozoonosis, 227

zebrafish, 314

© in this web service Cambridge University Press www.cambridge.org